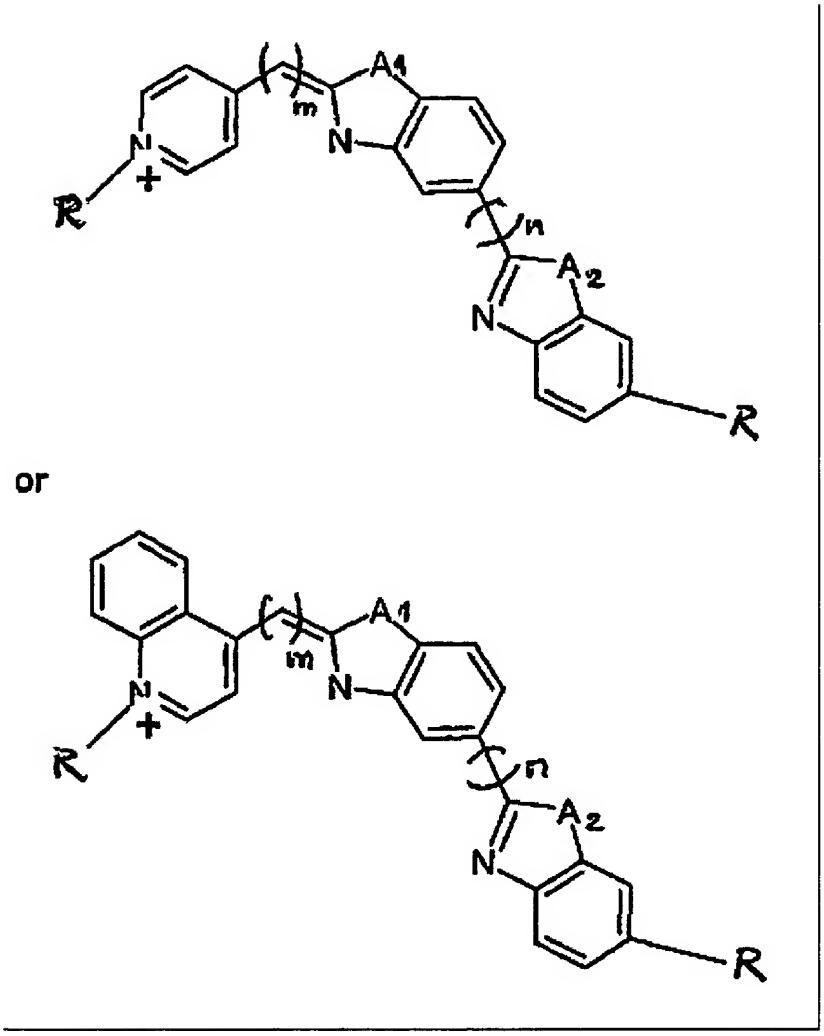
Claims

[c1] 1. A cyanine dye having the formula



wherein A_1 and A_2 are each independently O, S or N, and R is H or a carbohydrate, optionally containing a heteroatom, and m is an integer from 0 to 5, and n is an integer from 0 to 5.

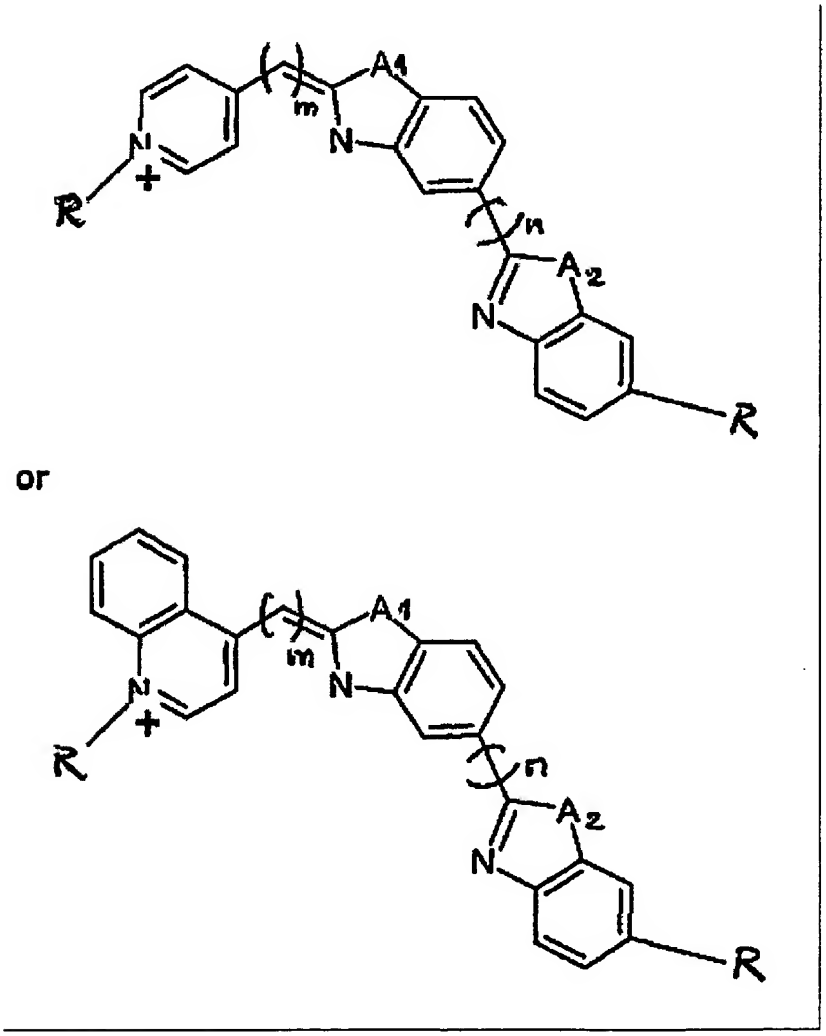
[c2] 2. ..The cyanine dye of claim 1, wherein R is methyl or ethyl, and m is 1 and n is 0.

[c3] 3. The cyanine dye of claim 1, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are S.

[c4] 4. The cyanine dye of claim 1, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are O.

[c5] 5. The cyanine dye of claim 1, wherein R is methyl or ethyl, m is 1 and n is 0, A_1 is S and A_2 is O.

[c6] 6. A hybridization probe comprising a sequence-recognizing nucleic acid portion and a reporter portion, wherein the reporter portion comprises a cyanine dye having the formula:



wherein A_1 and A_2 are each independently O, S or N, and R is H or a carbohydrate, optionally containing a heteroatom, and m is an integer from 0 to 5, and n is an integer from 0 to 5.

[c7] 7. The probe of claim 6, wherein R is methyl or ethyl, and m is 1 and n is 0.

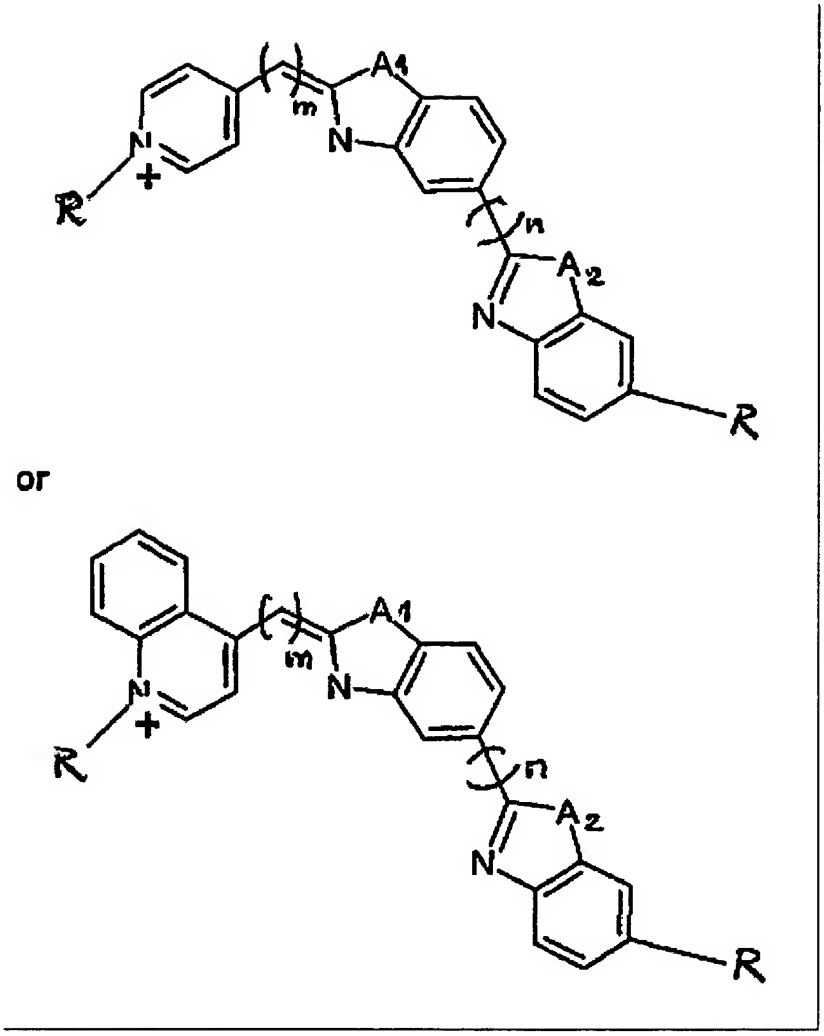
[c8] 8. The probe of claim 6, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are S.

[c9] 9. The probe of claim 6, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are O.

[c10] 10. The probe of claim 6, wherein R is methyl or ethyl, m is 1 and n is 0, A_1 is S and A_2 is O.

[c11] 11. A method for detecting the presence of double-stranded DNA in a sample comprising the steps of:

introducing into the sample a cyanine dye having the formula:



wherein A_1 and A_2 are each independently O, S or N, and R is H or a carbohydrate, optionally containing a heteroatom, and m is an integer from 0 to 5, and n is an integer from 0 to 5; and

detecting fluorescence from the cyanine dye, wherein the fluorescence intensity from the cyanine dye is increased in the presence of double-stranded DNA as a result of binding of the cyanine dye in the minor groove of the double-stranded DNA.

[c12] 12. The method of claim 11, wherein R is methyl or ethyl, and m is 1 and n is 0.

[c13] 13. The method of claim 11, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are S.

[c14] 14. The method of claim 11, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are O.

[c15] 15. The method of claim 11, wherein R is methyl or ethyl, m is 1 and n is 0, A_1 is S and A_2 is O.

[c16] 16. A method for monitoring a real time PCR reaction by detection of the formation of double-stranded DNA, comprising the steps of performing real time PCR in the presence of a fluorescent dye that interacts with double-stranded DNA, and monitoring fluorescence from the fluorescent dye, wherein the fluorescent dye increases its fluorescent intensity when it is locked in a minor groove position in double stranded DNA, and wherein the dye comprises at least 2 aromatic ring systems both comprising at least one nitrogen atom, which rings are linked by a alkyne group having up to four carbon atoms to form a conjugated bond, and the dye further comprises at least a third aromatic system linked thereto via a bond having a significant double string character, such as a single bond or a ethyne bond, to provide a stiff conjugated system.

[c17] 17. The method of claim 16, wherein the dye is an asymmetric cyanine dye comprising two different cyanine residues.

[c18] 18. The method of claim 16, wherein one of the cyanine residues contains S or O as a heteroatom.

[c19] 19. The method of claim 16, wherein the dye compound is crescent shaped.

[c20] 20. The method of claim 16, wherein the cyanine dye has the formula:
wherein A_1 and A_2 are each independently O, S or N, and R is H or a carbohydrate, optionally containing a heteroatom, and m is an integer from 0 to 5, and n to an integer from 0 to 5.

[c21] 21. The method of claim 20, wherein R is methyl or ethyl, and m is 1 and n is0.

[c22] 22. The method of claim 20, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are S.

[c23] 23. The method of claim 20, wherein R is methyl or ethyl, m is 1 and n is 0, and A_1 and A_2 are O.

[c24] 24. The method of claim 20, wherein R is methyl or ethyl, m is 1 and n is 0, A_1 is S and A_2 is O.